

SO-267: ARCHIMEDES I Expedition with RV SONNE

Weekly Report No. 6 (14 to 21 January, 2019)

On Monday 14 January, the multichannel seismic (MCS) profile BGR18-202 was completed in the northern part of the working area, and preparations were made to move to line BGR18-201, the northernmost of our profiles. Profile BGR18-201 is a short ~100-km line crossing the overlap between the northern Fonualei Rift, the southern tip of the Northeast Lau Spreading Centre, and the actively spreading north arm of the Mangatolu Triple Junction (MTJ). At this location, the NELSC is propagating toward the north end of the FRSC. We delayed the start of the survey after the mammal watch reported sighting a whale. After 2 hours and no additional sightings, we performed a slow ramp-up of the air guns and commenced MCS on line BGR18-201 in the evening. Shooting of BGR18-201 continued until Tuesday afternoon 15 January, when the long streamer and guns were recovered. Late on Tuesday evening and into Wednesday, we conducted the first dredging program in the northern study area, within the Central Volcanic Field (CVF) of the Niuafu'ou microplate.



The Niuafu'ou Central Volcanic Field is an enigmatic region of widespread intraplate volcanism, possibly related to ongoing deformation of the plate or structures inherited from earlier episodes of the basin opening (failed rifts?). Highly disorganized patches of high and low magnetization indicate a very complex intrusive and spreading history. As many as 200 individual volcanic cones (>1km diameter) have been counted in an area of less than 100 x 100 km. Although this type of intraplate volcanism appears to be a significant part of the total magmatic budget of the NE Lau Basin, it cannot be directly related to the presently active rifting or spreading.

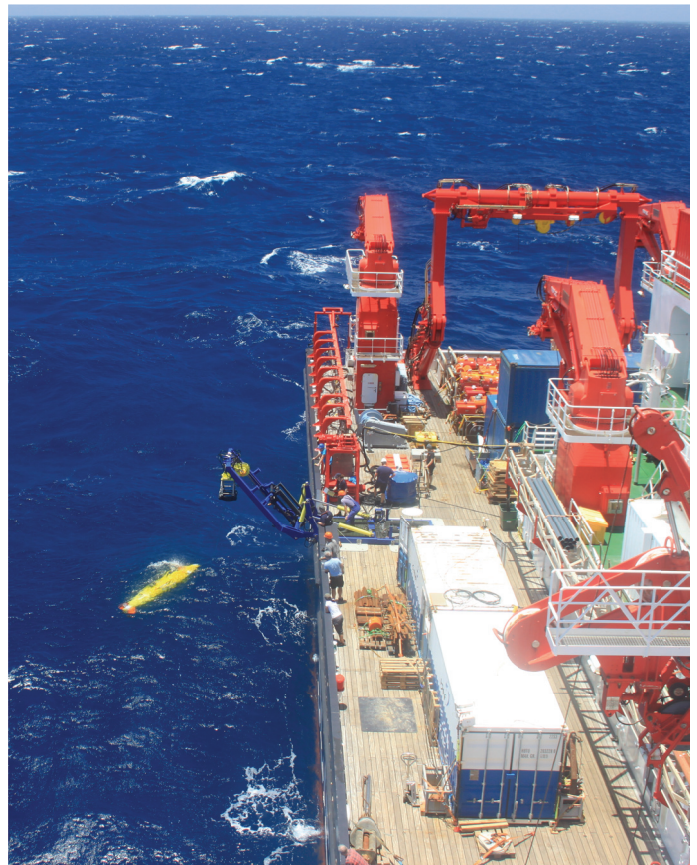
On Wednesday morning, 16 January, we redeployed the air guns to shoot the OBSs on line BGR18-202. This was the last operation with the air guns. Recovery of the OBSs commenced on Thursday morning and lasted until Friday, 18 January. During a pause in the recovery of the OBSs, we transited to the central part of the Mangatolu Triple Junction (MTJ) to deploy the AUV (Dive 313) on a plume mapping mission along the main spreading zone of its northern arm, thus completing an important part of the inventory of hydrothermal activity in the NE Lau Basin. The AUV was recovered late Friday afternoon, and on Friday night until Saturday, 19 January, we continued the sampling of volcanic rocks along the inner walls of the NELSC rift. These dredges recovered samples of the earliest formations of the back-arc crust in the propagating rift. We also sampled volcanic rocks from a very recent eruption along a ridge separating the NELSC from the MTJ. This ridge has previously been considered to be old crust stranded by the emergence of the triple junction, but instead it may be a new volcanic centre in the transfer zone between the propagating NELSC and the N-FRSC. During the dredging we deployed the AUV (Dive 314) on a sidescan survey over the location of known hydrothermal sites in the northern MTJ spreading center.

Early in the morning on Sunday 20 January, we transited back to line BGR18-203 to begin the long process of recovering the OBMTs that had been deployed there 5 weeks earlier. Recovery of the OBMTs continued through the end of the week (2 days), after which we plan to return to the northern

working area and complete our planned program for the cruise. A final AUV Dive (315) is planned to map high-density plumes in the S-FRSC during the OBMT recovery. This marked the end of a heroic effort by the 20-member geophysics team from GEOMAR and BGR. Overcoming the technological and physical challenges of deploying, running, and maintaining more than 100 seabed instruments and towed infrastructure during the cruise (including frequent recovery and redeployments) has been a major tribute to the dedication of the ship's crew and the science team.

Preliminary interpretations of our data began coming in during weeks 4 and 5, and we took the opportunity to have several working seminars to advance the ideas on the evolution of the Niuafou microplate and rift system. We lined the corridors of the vessel with seismic sections which are now being studied intently by everyone on board.

With best regards from RV SONNE,
Mark Hannington and Heidrun Kopp



Right: Recovering one of GEOMAR's air-gun clusters after the final deployment (photo by P. Brandl). In week 6, all of the multi-channel seismic and refraction surveys were completed. **Left:** Releasing the AUV Abyss for one of its 8 dives to map the structure and hydrothermal plumes in the FRSC and MTJ (photo by Florian Schmidt).